ENSO: Recent Evolution, Current Status and Predictions

Update prepared by:
Climate Prediction Center / NCEP
25 February 2019

Outline

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Recent Evolution and Current Conditions

Oceanic Niño Index (ONI)

Pacific SST Outlook

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ENSO Alert System Status: El Niño Advisory

El Niño conditions are present.*

Equatorial sea surface temperatures (SSTs) are above average across most of the Pacific Ocean.

The pattern of anomalous convection and winds are consistent with El Niño.

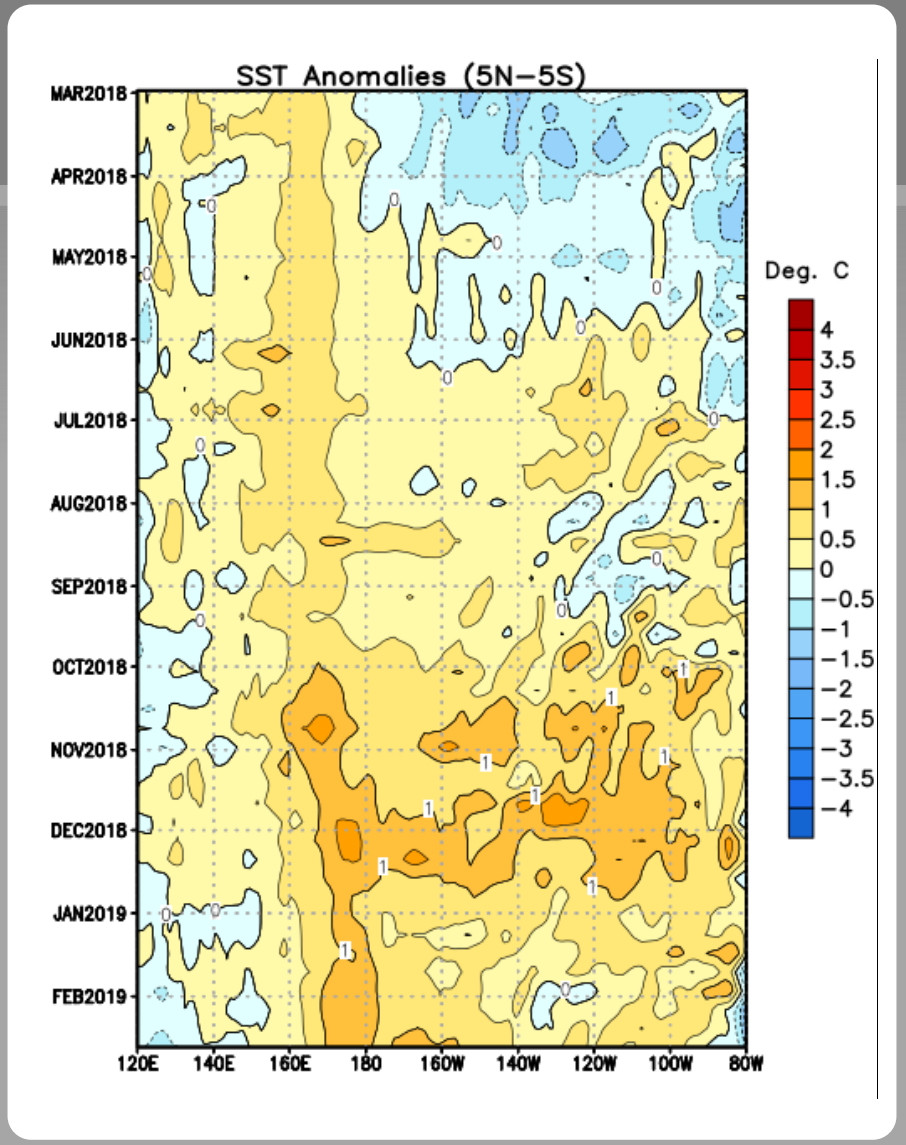
Weak El Niño conditions are expected to continue through the Northern Hemisphere spring 2019 (~55% chance).*

*** Note: These statements are updated once a month (2nd Thursday of each month) in association with the ENSO Diagnostics Discussion, which can be found by clicking here.**

Recent Evolution of Equatorial Pacific SST Departures (°C)

Since early June 2018, near-to-above average SSTs have been present across most of the Pacific Ocean.

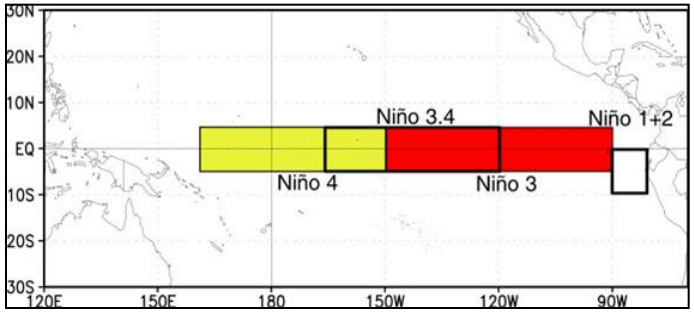
Since the beginning of February 2019, positive SST anomalies have strengthened across most of the equatorial Pacific.

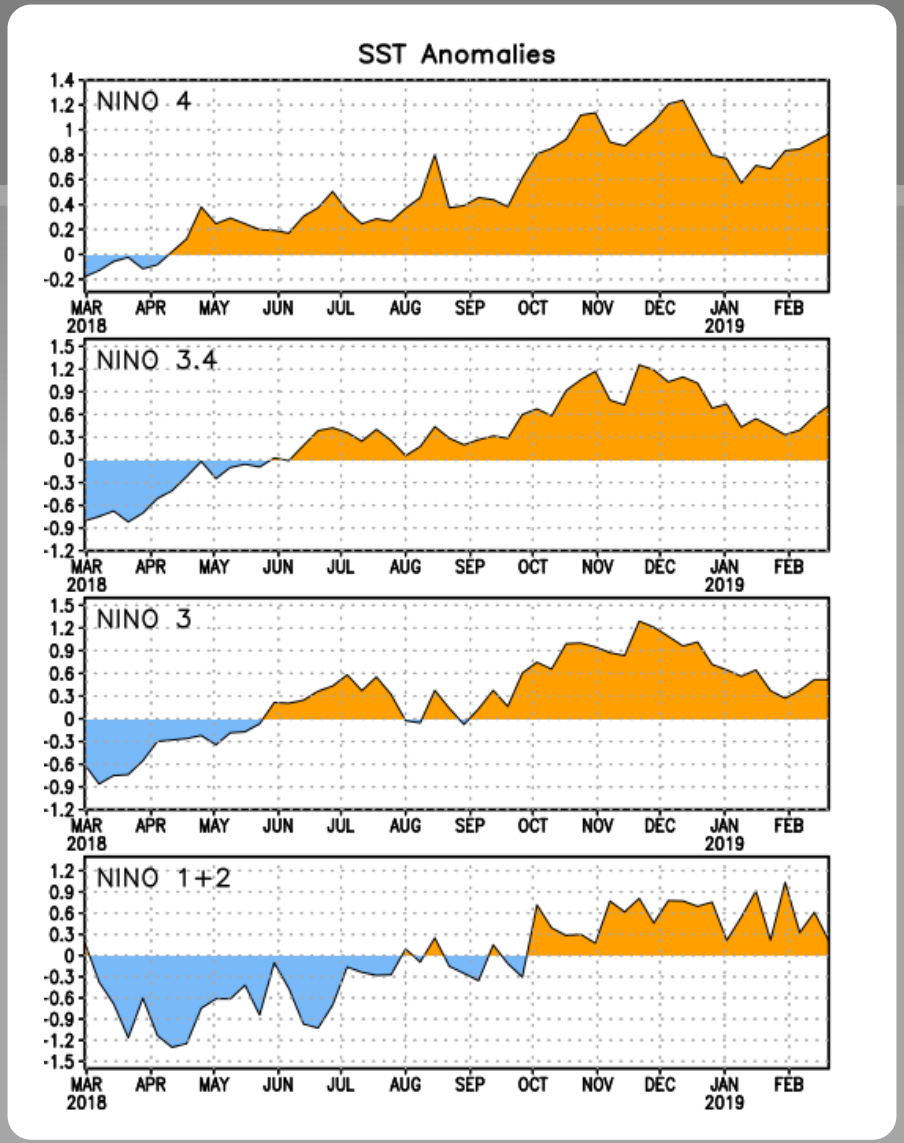


Niño Region SST Departures (ºC) Recent Evolution

The latest weekly SST departures are:

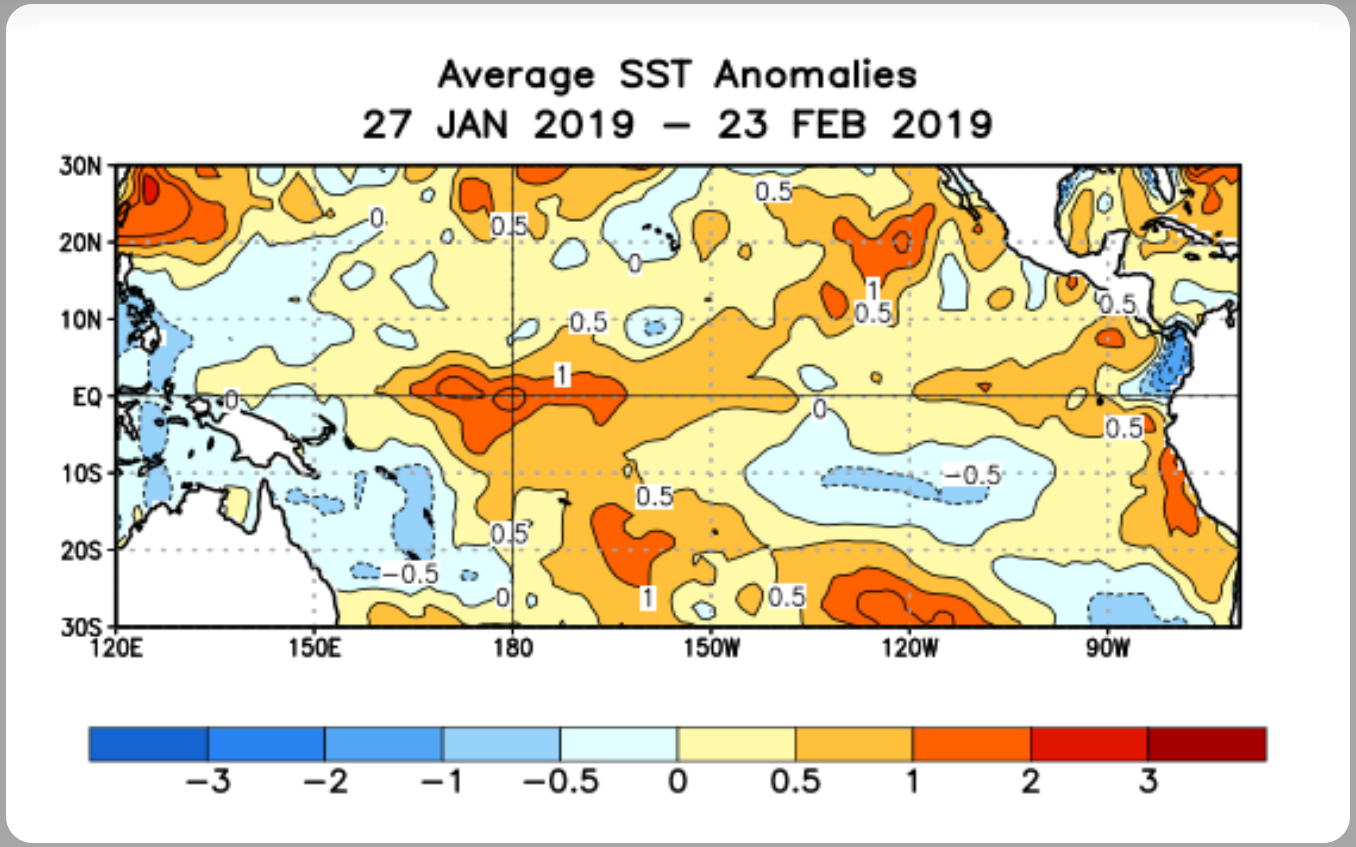
Niño 4	1.0ºC
Niño 3.4	0.7ºC
Niño 3	0.5ºC
Niño 1+2	0.2ºC





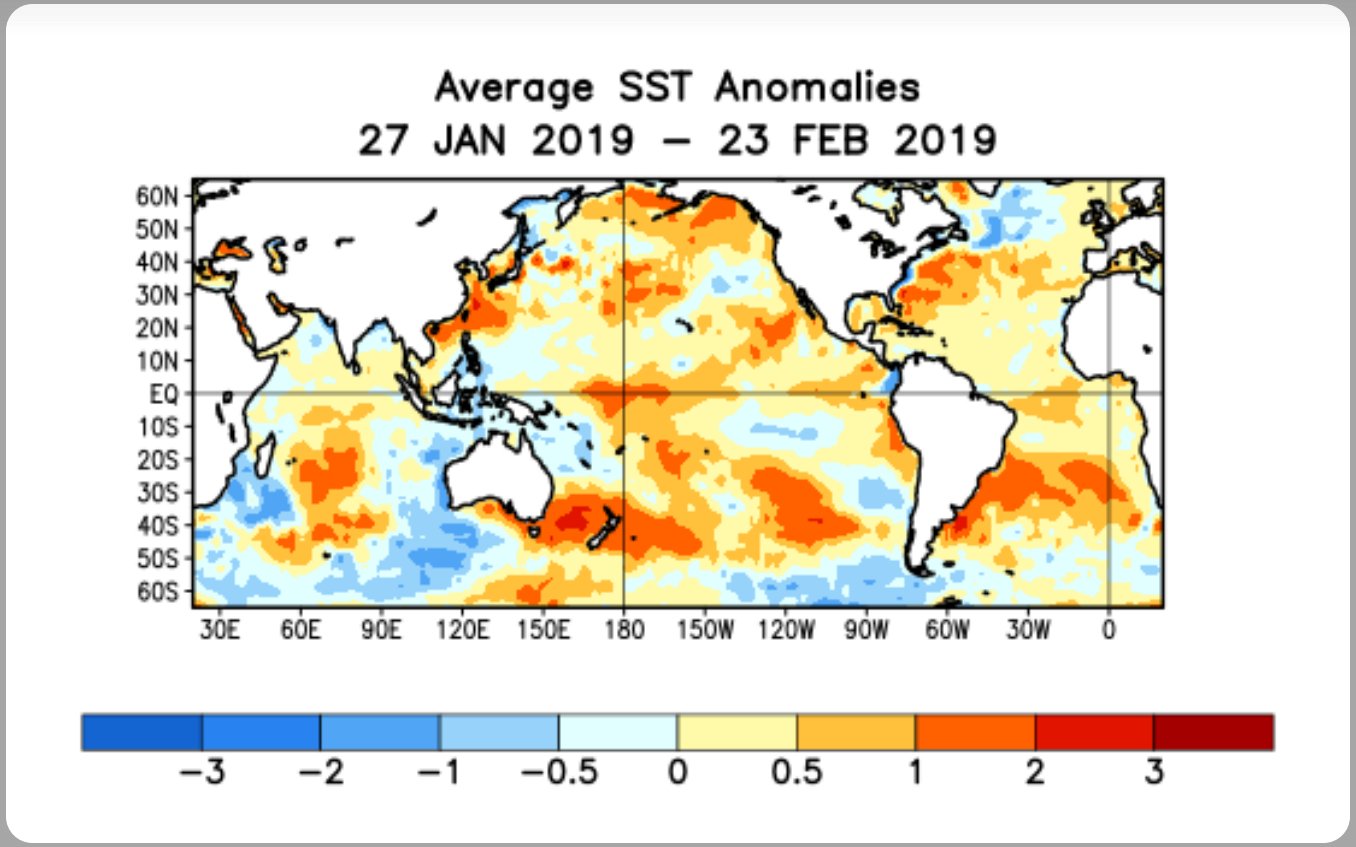
SST Departures (ºC) in the Tropical Pacific During the Last Four Weeks

During the last four weeks, equatorial SSTs were above average across most of the Pacific Ocean, with the strongest departures near the Date Line.



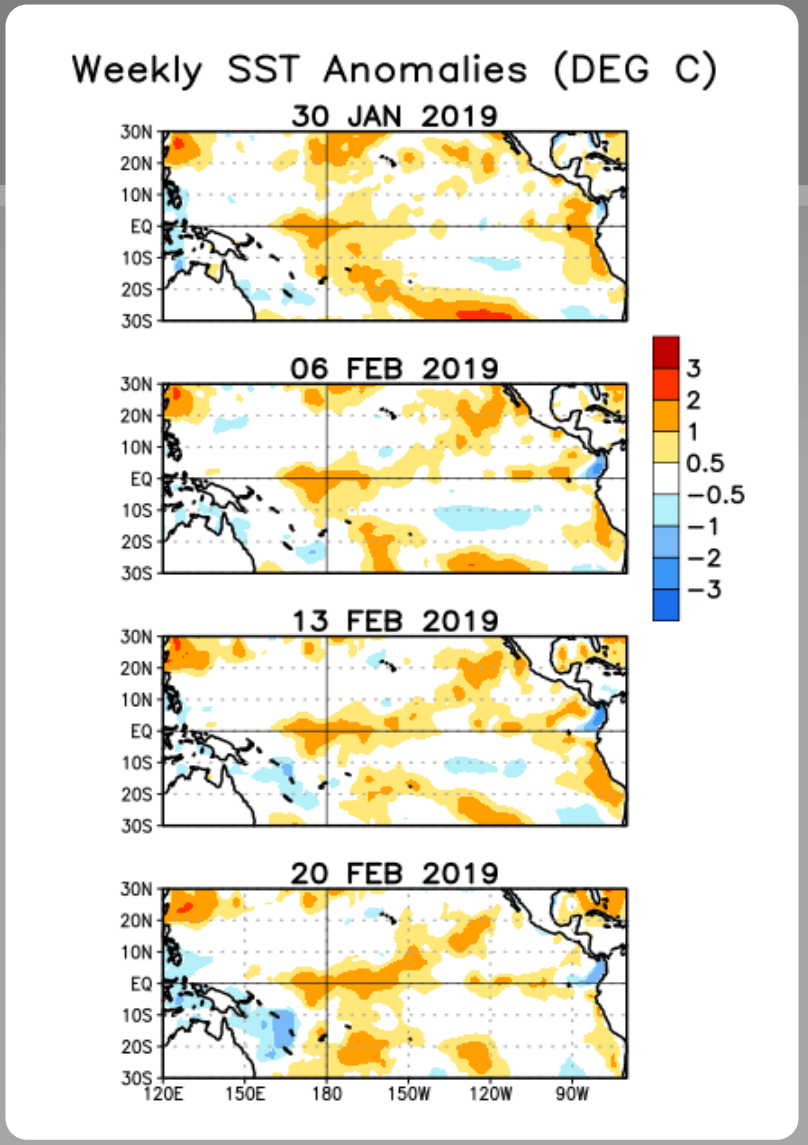
Global SST Departures (°C) During the Last Four Weeks

During the last four weeks, equatorial SSTs were above average across most of the Pacific Ocean and central Atlantic Ocean. Equatorial SSTs were below average near Indonesia.



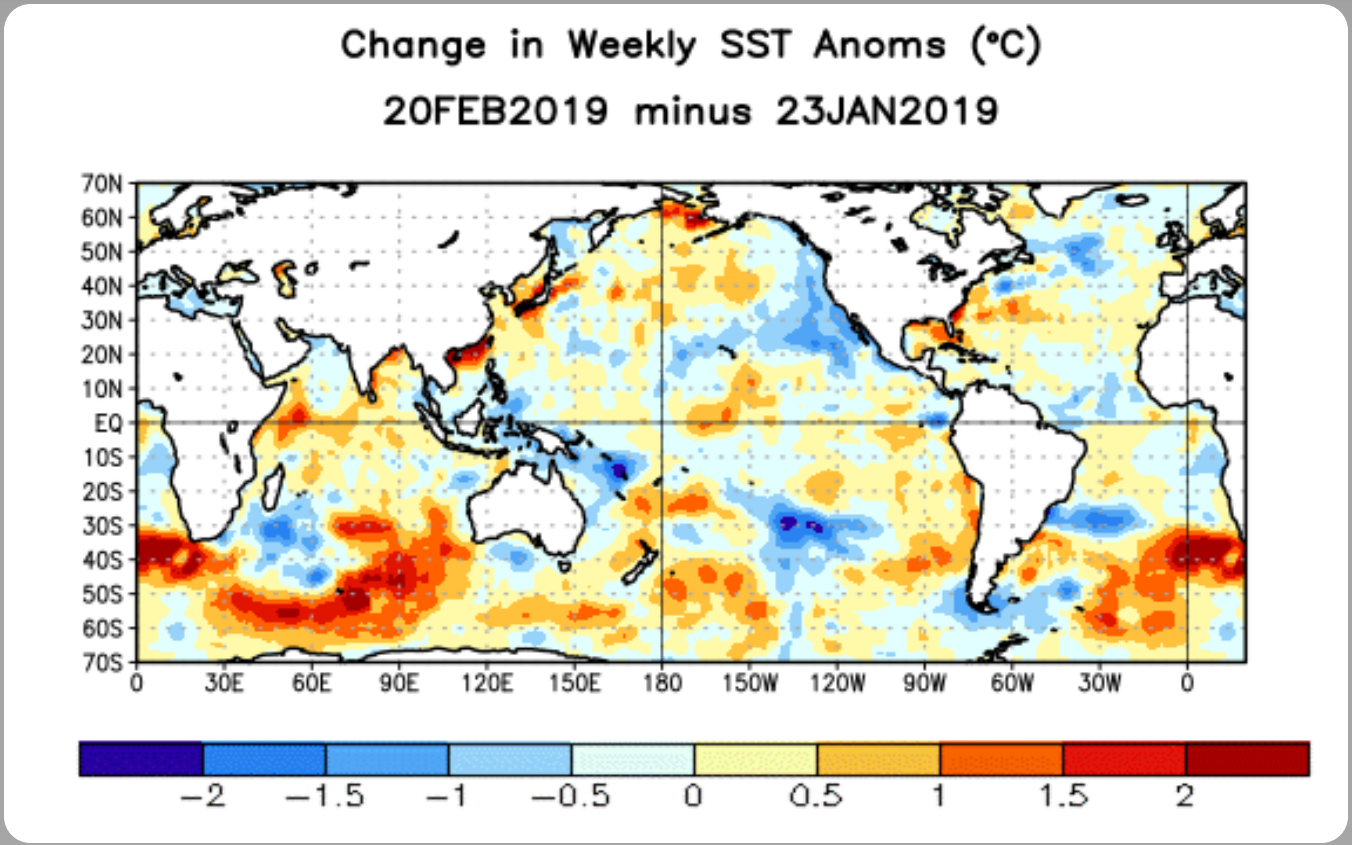
Weekly SST Departures during the Last Four Weeks

During the last four weeks, above-average SSTs have expanded across the equatorial Pacific Ocean.



Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, negative changes were observed in the far eastern equatorial Pacific Ocean and near Indonesia, while positive changes were apparent just to the east of the Date Line.



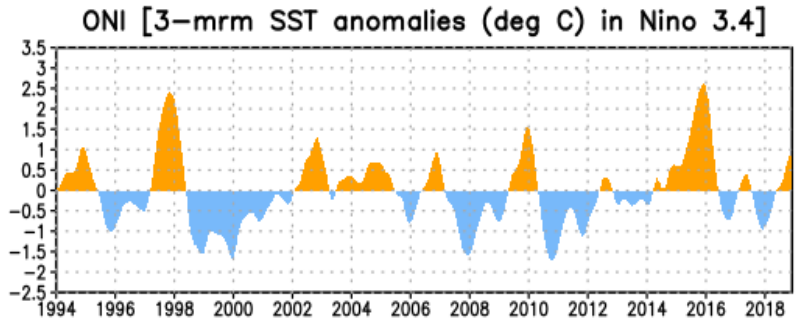
Upper-Ocean Conditions in the Equatorial Pacific

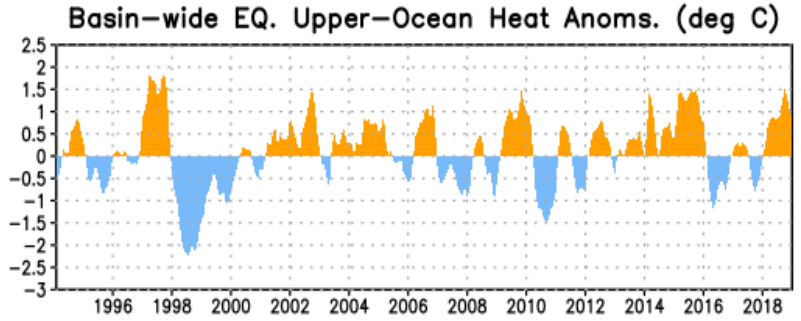
The basin-wide equatorial upper ocean (0-300 m) heat content is greatest prior to and during the early stages of a Pacific warm (El Niño) episode (compare top 2 panels), and least prior to and during the early stages of a cold (La Niña) episode.

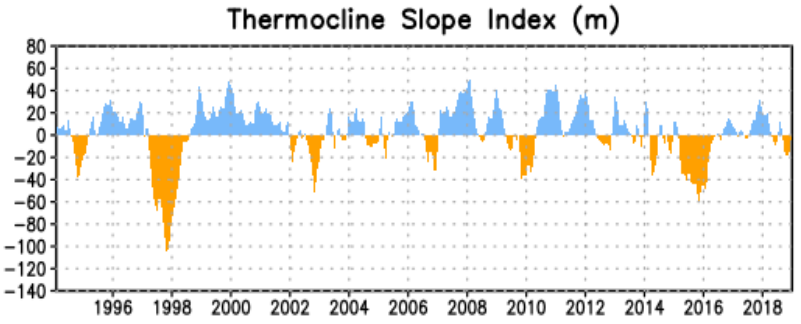
The slope of the oceanic thermocline is least (greatest) during warm (cold) episodes.

Recent values of the upper-ocean heat anomalies (above average) and thermocline slope index (below average) reflect El Niño conditions.

The monthly thermocline slope index represents the difference in anomalous depth of the 20°C isotherm between the western Pacific (160°E-150°W) and the eastern Pacific (90°-140°W).

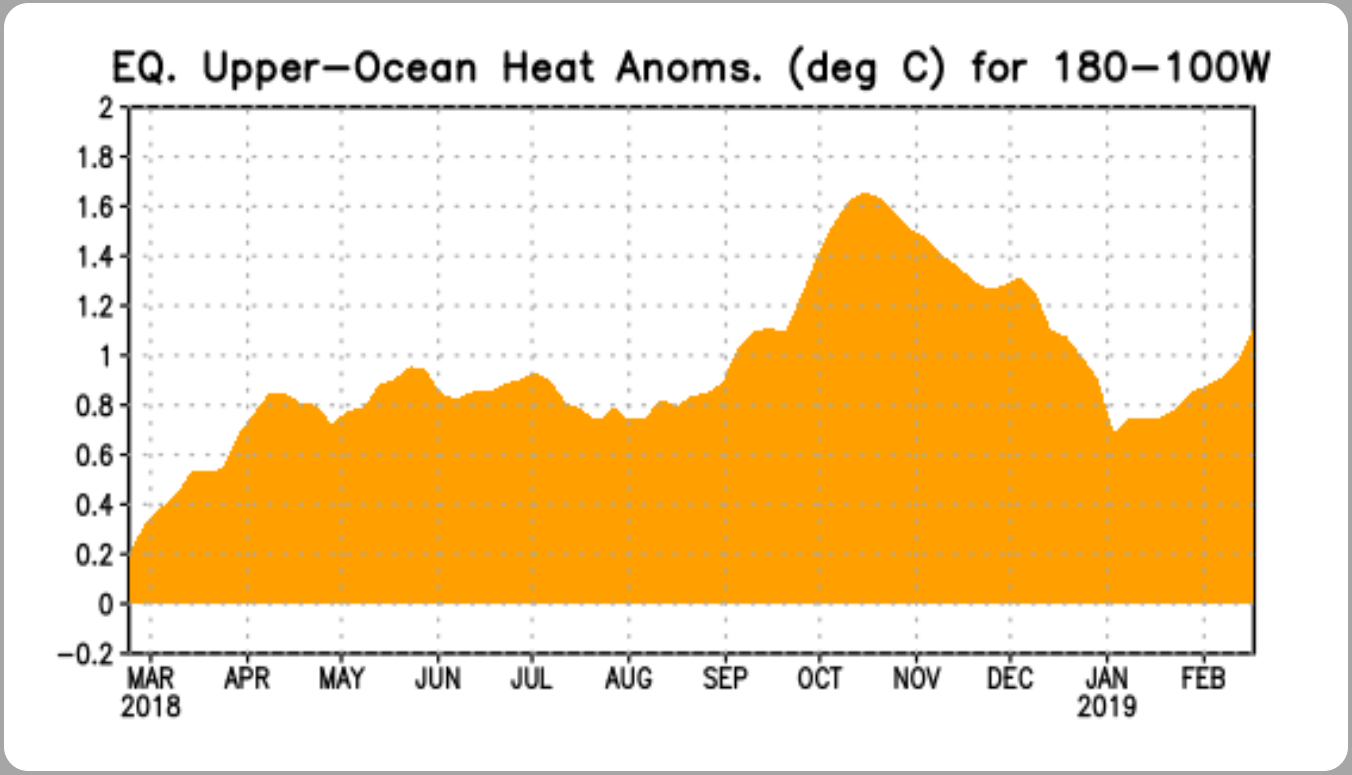






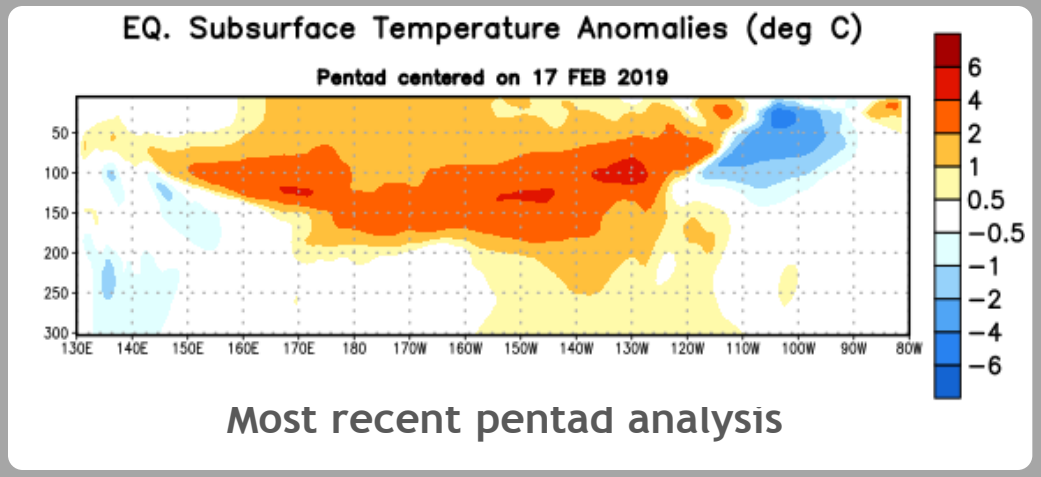
Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

Positive subsurface temperature anomalies have been present since the end of February 2018, with a peak in October and a minimum in early January 2019. Positive anomalies have increased since January 2019.



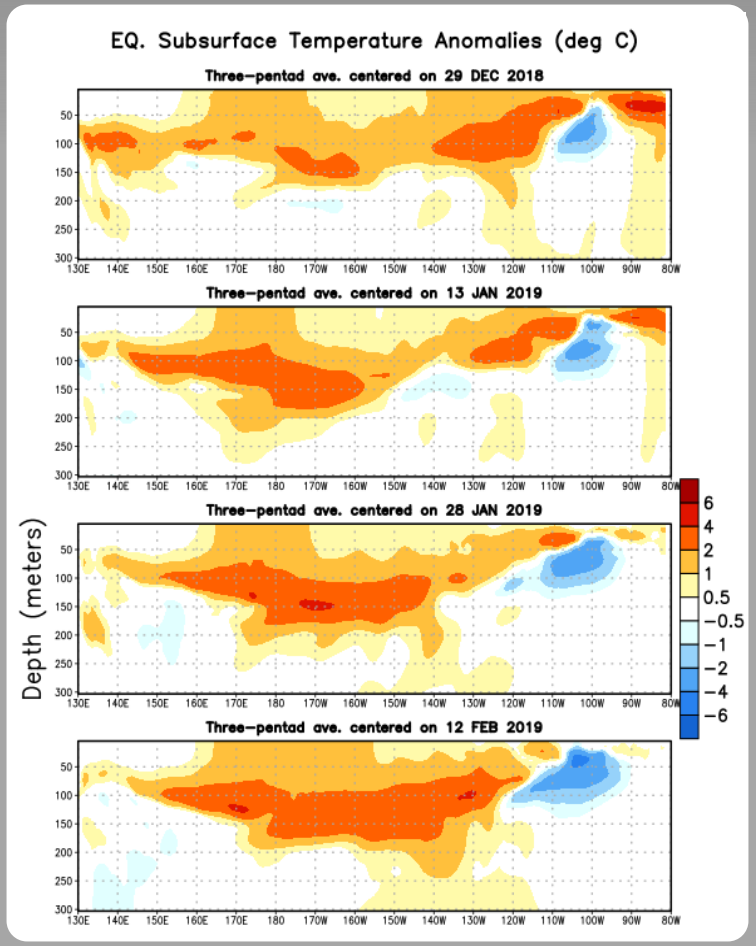
Sub-Surface Temperature Departures in the Equatorial Pacific

In the last two months, positive subsurface temperature anomalies have persisted across most of the equatorial Pacific Ocean.



Most recent pentad analysis

Since mid-December 2018, negative subsurface temperature anomalies have persisted between 90-120°W.

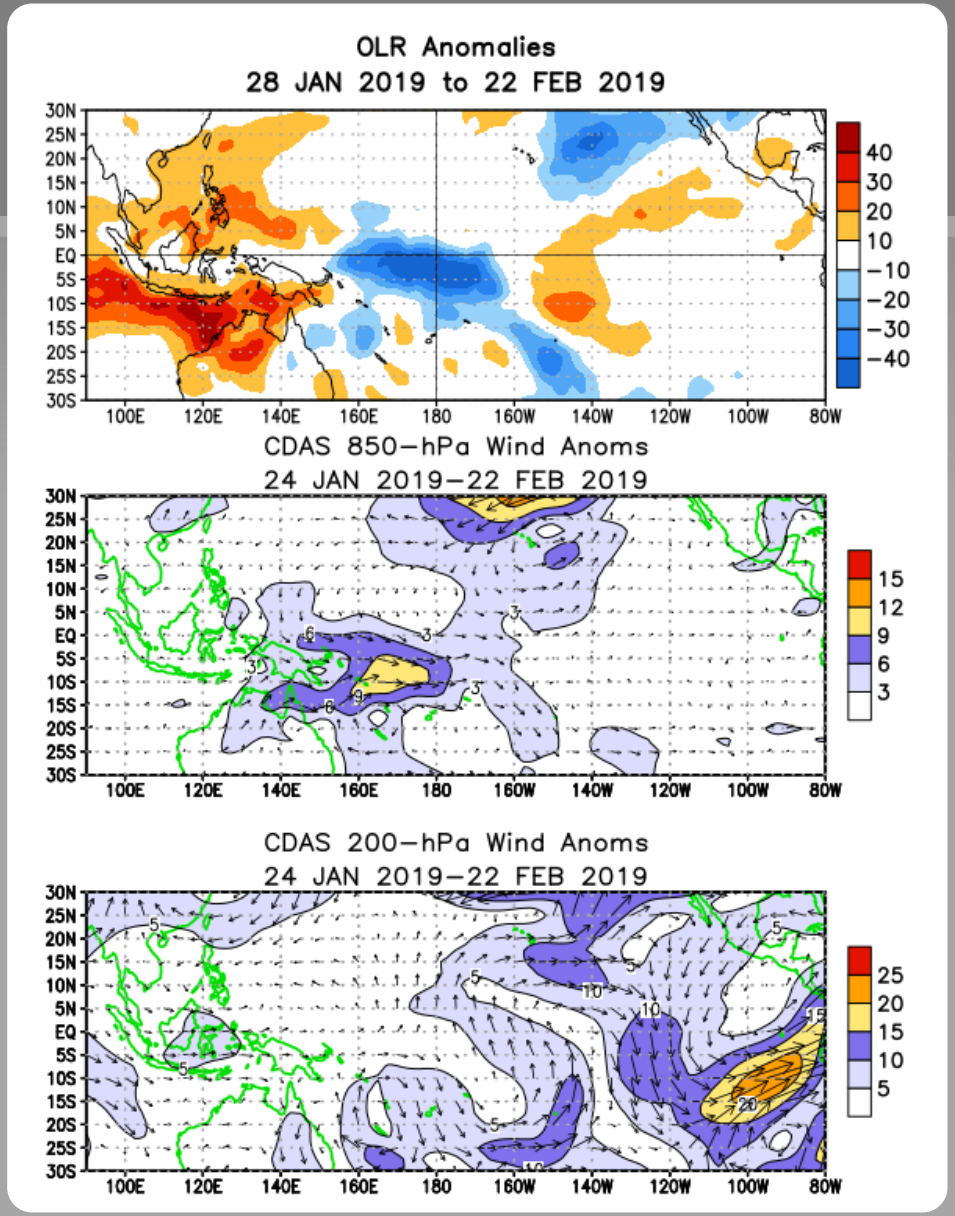


Tropical OLR and Wind Anomalies During the Last 30 Days

Positive OLR anomalies (suppressed convection and precipitation) were evident around Indonesia and the Philippines. Negative OLR anomalies (enhanced convection and precipitation) were prominent around the Date Line.

Anomalous low-level (850-hPa) westerly winds were evident over the western and central tropical Pacific.

Anomalous upper-level (200-hPa) cross-equatorial flow was observed over the east-central and eastern Pacific.



Intraseasonal Variability

Intraseasonal variability in the atmosphere (wind and pressure), which is often related to the Madden-Julian Oscillation (MJO), can significantly impact surface and subsurface conditions across the Pacific Ocean.

Related to this activity:

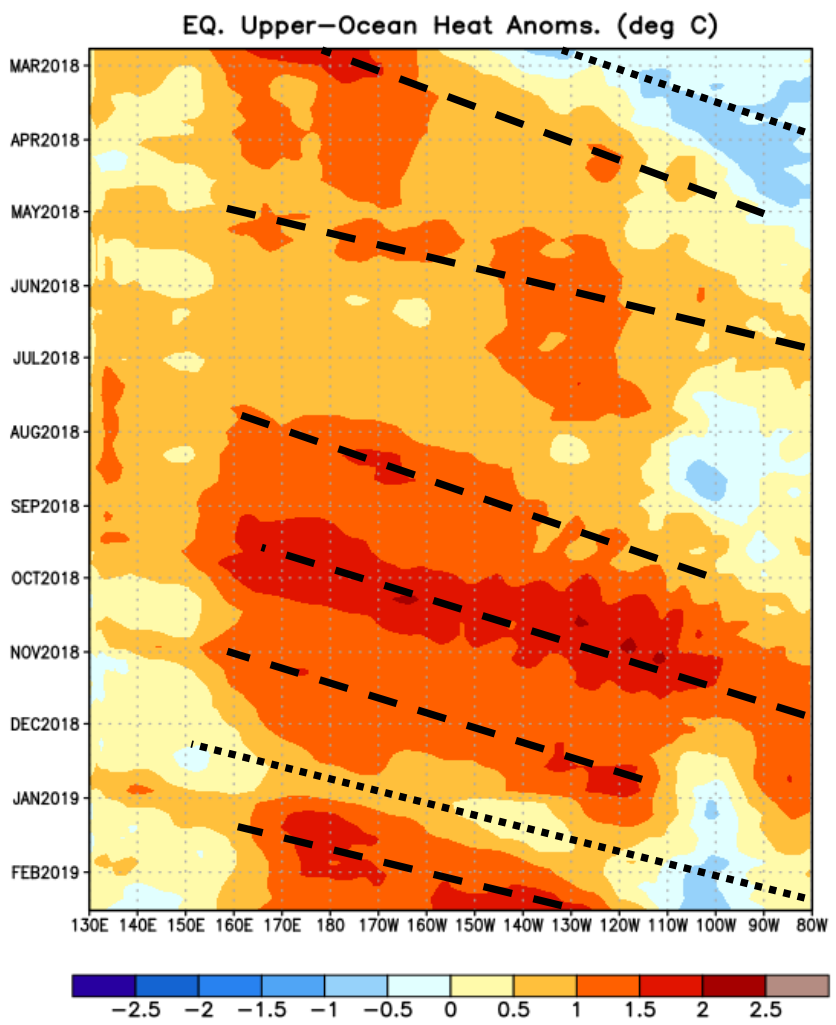
Significant weakening of the low-level easterly winds usually initiates an eastward-propagating oceanic Kelvin wave.

Weekly Heat Content Evolution in the Equatorial Pacific

In early August, October, and November 2018, positive subsurface temperature anomalies increased, partly due to downwelling Kelvin waves.

From mid-December 2018 to present, positive subsurface temperature anomalies weakened between 120°W and 80°W, partially due to an upwelling Kelvin wave.

Since early January 2019, a downwelling Kelvin wave increased the positive subsurface temperature anomalies across the central and east-central Pacific.



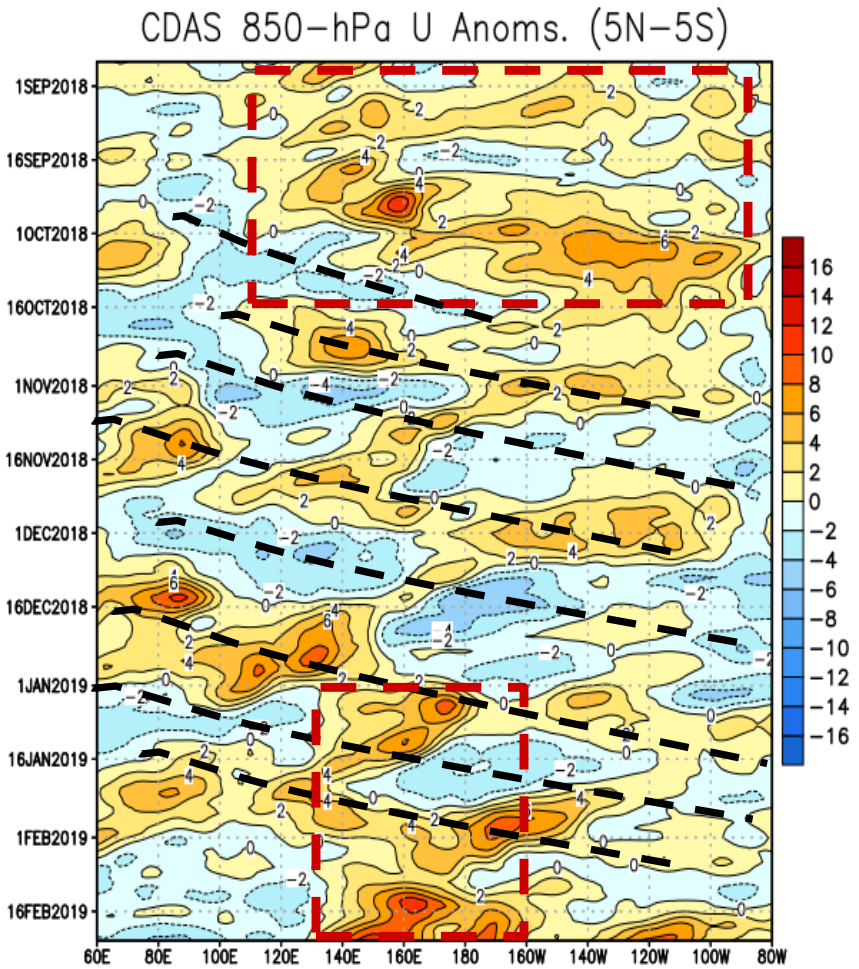
Equatorial oceanic Kelvin waves have alternating warm and cold phases. The warm phase is indicated by dashed lines. Down-welling and warming occur in the leading portion of a Kelvin wave, and up-welling and cooling occur in the trailing portion.

Low-level (850-hPa) Zonal (east-west) Wind Anomalies (m s^{-1})

At times, the Madden Julian Oscillation (MJO) contributed to the eastward propagation of low-level wind anomalies.

From mid-July to early October, westerly wind anomalies prevailed over the eastern Pacific.

Since early January 2019, westerly wind anomalies have generally persisted over the west-central equatorial Pacific Ocean.

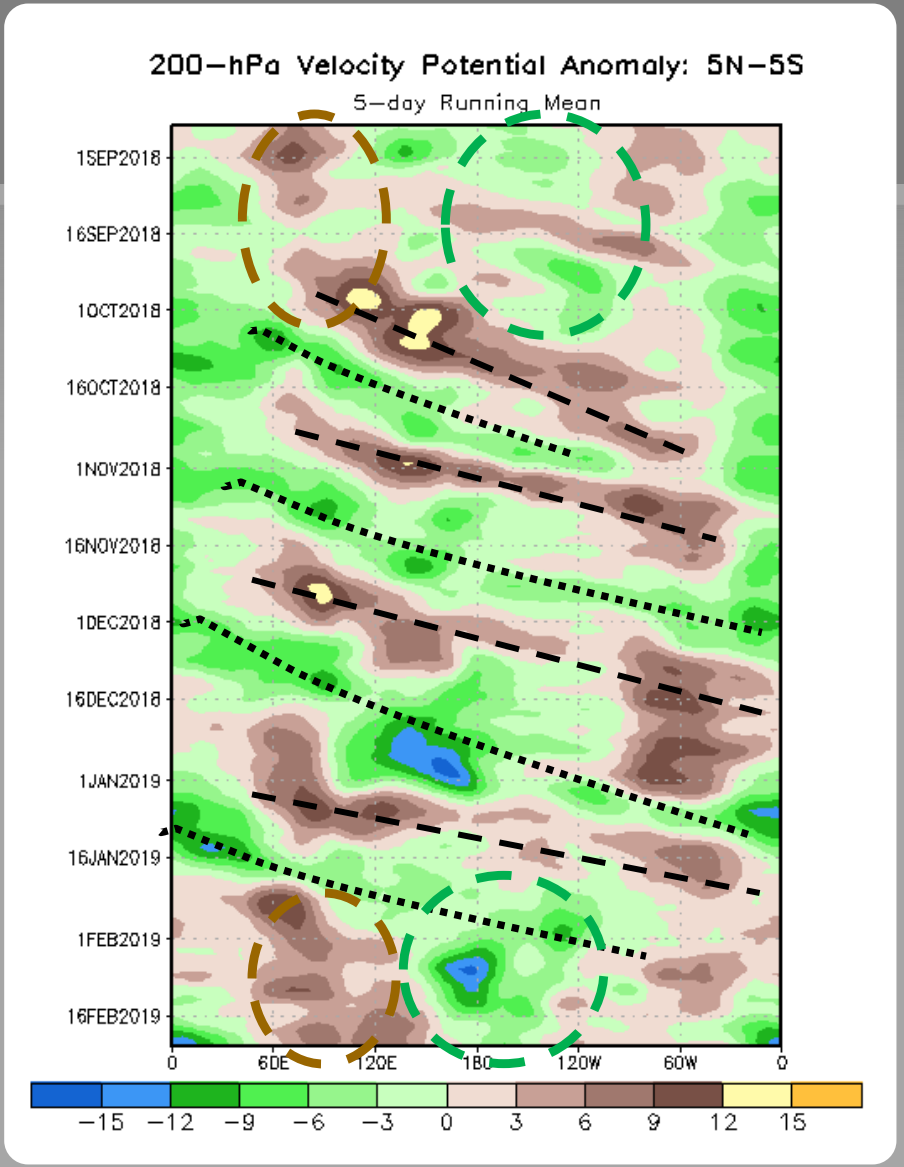


Westerly Wind Anomalies (orange/red shading)
Easterly Wind Anomalies (blue shading)

Upper-level (200-hPa) Velocity Potential Anomalies

Since October 2018, eastward propagation has been evident in the anomalies.

Since mid January 2019, anomalous upper-level divergence (green shading) persisted near the Date Line, while anomalous upper-level convergence (brown shading) occurred near Indonesia and the eastern Indian Ocean.



Unfavorable for precipitation (brown shading)
Favorable for precipitation (green shading)

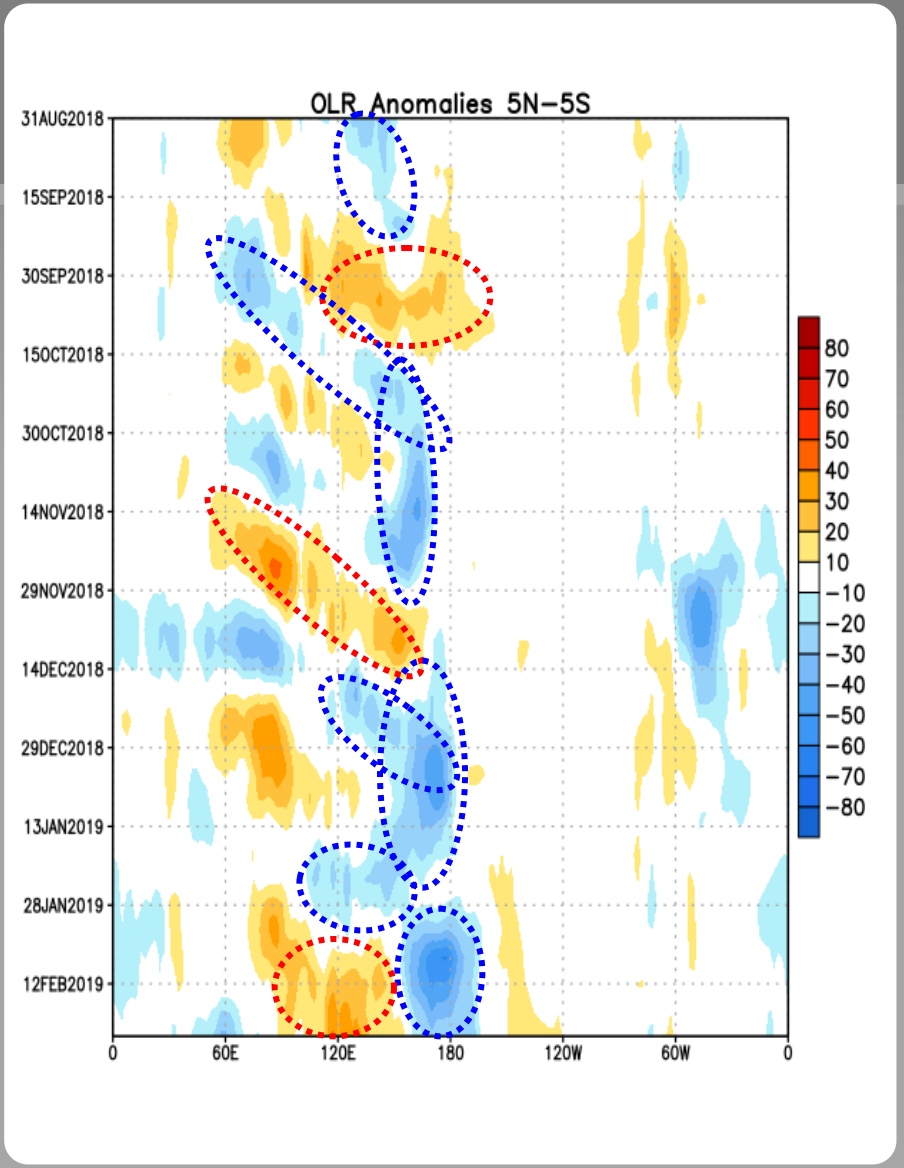
Note: Eastward propagation is not necessarily indicative of the Madden-Julian Oscillation (MJO).

Outgoing Longwave Radiation (OLR) Anomalies

From mid-July to mid-August, positive OLR anomalies persisted over the central Pacific Ocean.

From mid-October to late November 2018 and again between mid-December to mid January 2019, negative OLR anomalies persisted over the western Pacific.

Since early February 2019, positive OLR anomalies have persisted over Indonesia, while negative OLR anomalies have continued near the Date Line.



Drier-than-average Conditions (orange/red shading)
Wetter-than-average Conditions (blue shading)

Oceanic Niño Index (ONI)

The ONI is based on SST departures from average in the Niño 3.4 region, and is a principal measure for monitoring, assessing, and predicting ENSO.

Defined as the three-month running-mean SST departures in the Niño 3.4 region. Departures are based on a set of improved homogeneous historical SST analyses (Extended Reconstructed SST – ERSST.v5). The SST reconstruction methodology is described in Huang et al., 2017, J. Climate, vol. 30, 8179-8205.)

It is one index that helps to place current events into a historical perspective

NOAA Operational Definitions for El Niño and La Niña

El Niño: characterized by a positive ONI greater than or equal to +0.5°C.

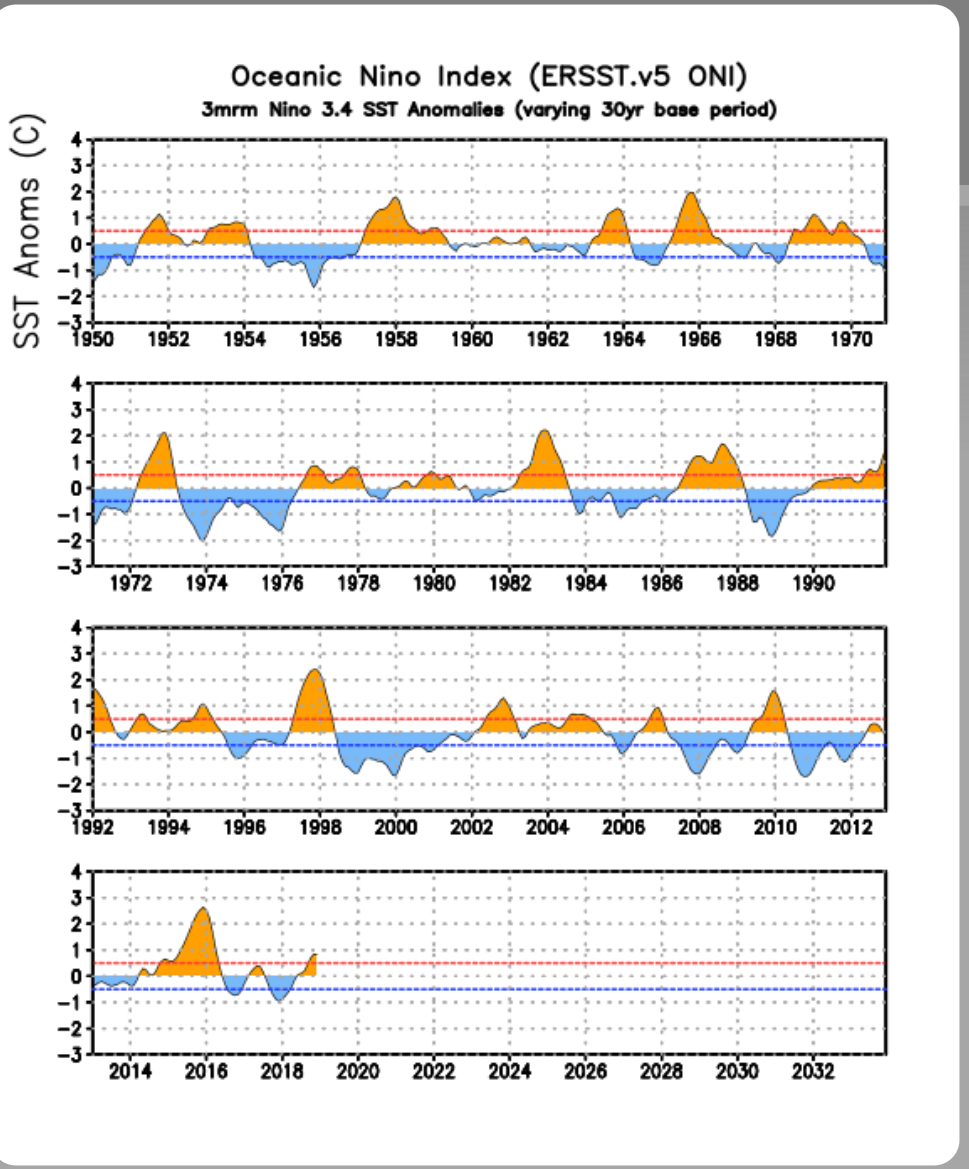
La Niña: characterized by a negative ONI less than or equal to -0.5°C.

By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

CPC considers El Niño or La Niña conditions to occur when the monthly Niño3.4 OISST departures meet or exceed +/- 0.5°C along with consistent atmospheric features. These anomalies must also be forecasted to persist for 3 consecutive months.

ONI (°C): Evolution since 1950

The most recent ONI value (November 2018 - January 2019) is +0.8°C.



Historical El Niño and La Niña Episodes Based on the ONI computed using ERSST.v5

Recent Pacific warm (red) and cold (blue) periods based on a threshold of +/- 0.5 °C for the Oceanic Nino Index (ONI) [3 month running mean of ERSST.v5 SST anomalies in the Nino 3.4 region (5N-5S, 120-170W)]. For historical purposes, periods of below and above normal SSTs are colored in blue and red when the threshold is met for a minimum of 5 consecutive over-lapping seasons.

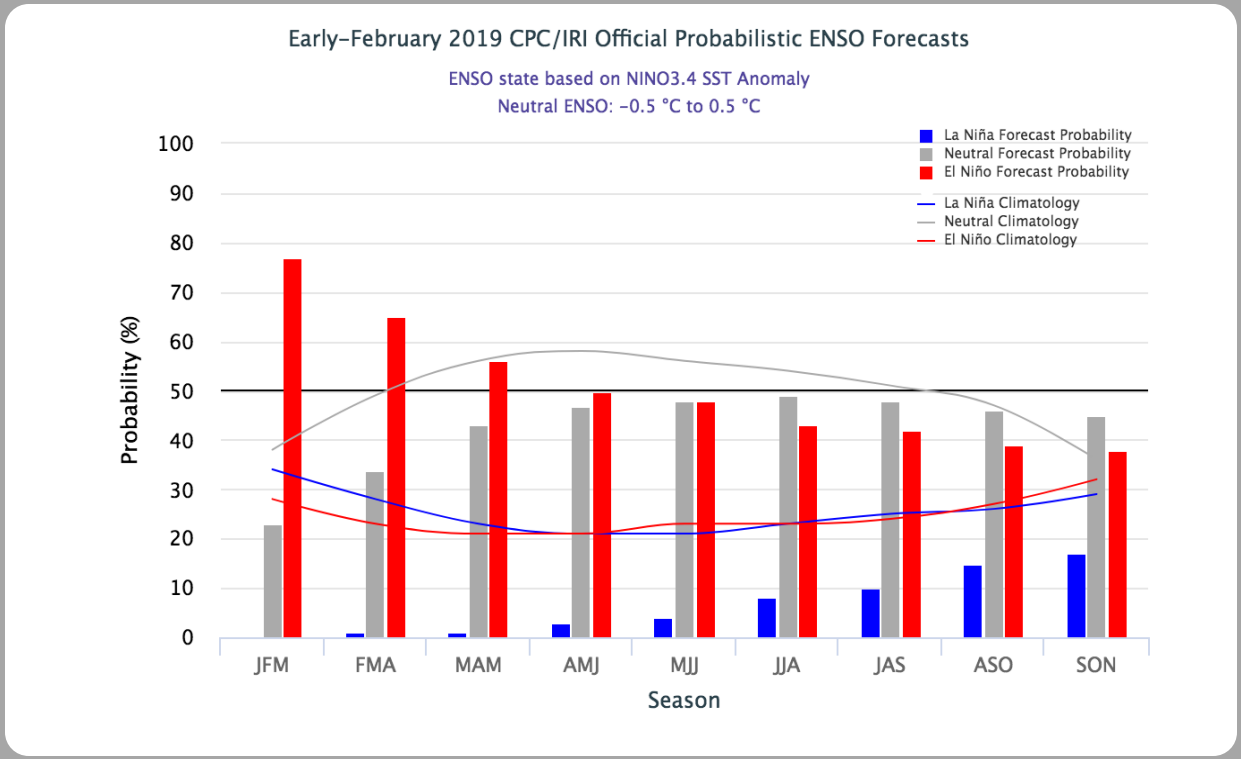
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found here.

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2006	-0.8	-0.7	-0.5	-0.3	0.0	0.0	0.1	0.3	0.5	0.7	0.9	0.9
2007	0.7	0.3	0.0	-0.2	-0.3	-0.4	-0.5	-0.8	-1.1	-1.4	-1.5	-1.6
2008	-1.6	-1.4	-1.2	-0.9	-0.8	-0.5	-0.4	-0.3	-0.3	-0.4	-0.6	-0.7
2009	-0.8	-0.7	-0.5	-0.2	0.1	0.4	0.5	0.5	0.7	1.0	1.3	1.6
2010	1.5	1.3	0.9	0.4	-0.1	-0.6	-1.0	-1.4	-1.6	-1.7	-1.7	-1.6
2011	-1.4	-1.1	-0.8	-0.6	-0.5	-0.4	-0.5	-0.7	-0.9	-1.1	-1.1	-1.0
2012	-0.8	-0.6	-0.5	-0.4	-0.2	0.1	0.3	0.3	0.3	0.2	0.0	-0.2
2013	-0.4	-0.3	-0.2	-0.2	-0.3	-0.3	-0.4	-0.4	-0.3	-0.2	-0.2	-0.3
2014	-0.4	-0.4	-0.2	0.1	0.3	0.2	0.1	0.0	0.2	0.4	0.6	0.7
2015	0.6	0.6	0.6	0.8	1.0	1.2	1.5	1.8	2.1	2.4	2.5	2.6
2016	2.5	2.2	1.7	1.0	0.5	0.0	-0.3	-0.6	-0.7	-0.7	-0.7	-0.6
2017	-0.3	-0.1	0.1	0.3	0.4	0.4	0.2	-0.1	-0.4	-0.7	-0.9	-1.0
2018	-0.9	-0.8	-0.6	-0.4	-0.1	0.1	0.1	0.2	0.4	0.7	0.9	0.8

CPC/IRI Probabilistic ENSO Outlook

Updated: 14 February 2019

El Niño conditions have formed and are favored to continue through the Northern Hemisphere spring 2019 (~55% chance).



IRI/CPC Pacific Niño 3.4 SST Model Outlook

The majority of models predict a weak El Niño to continue into the Northern Hemisphere summer 2019.

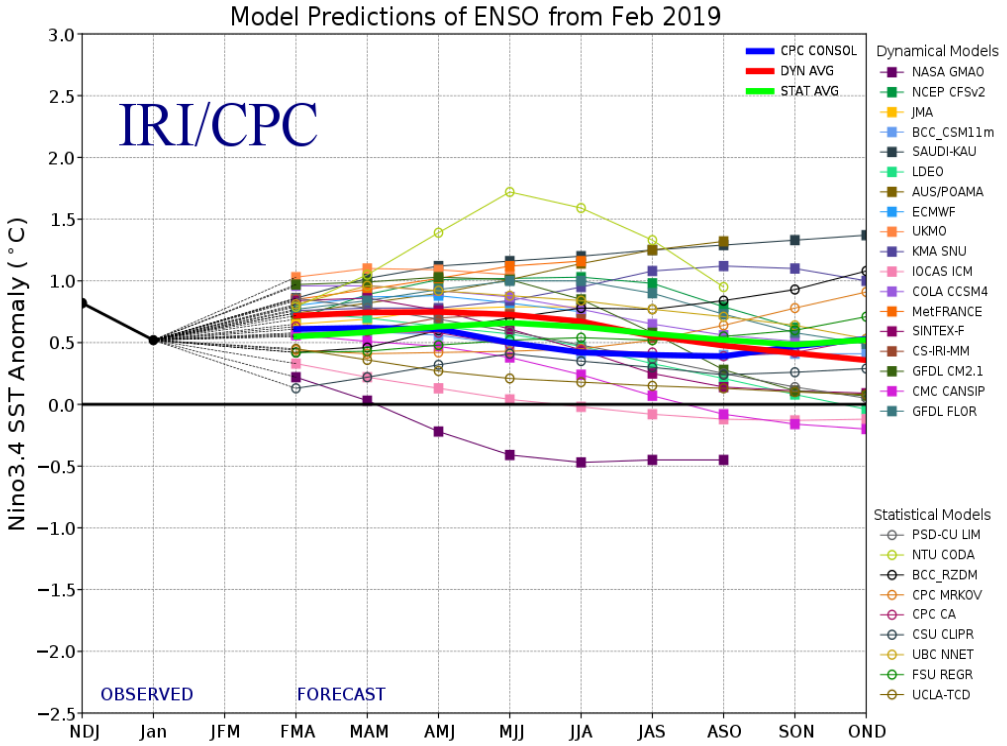
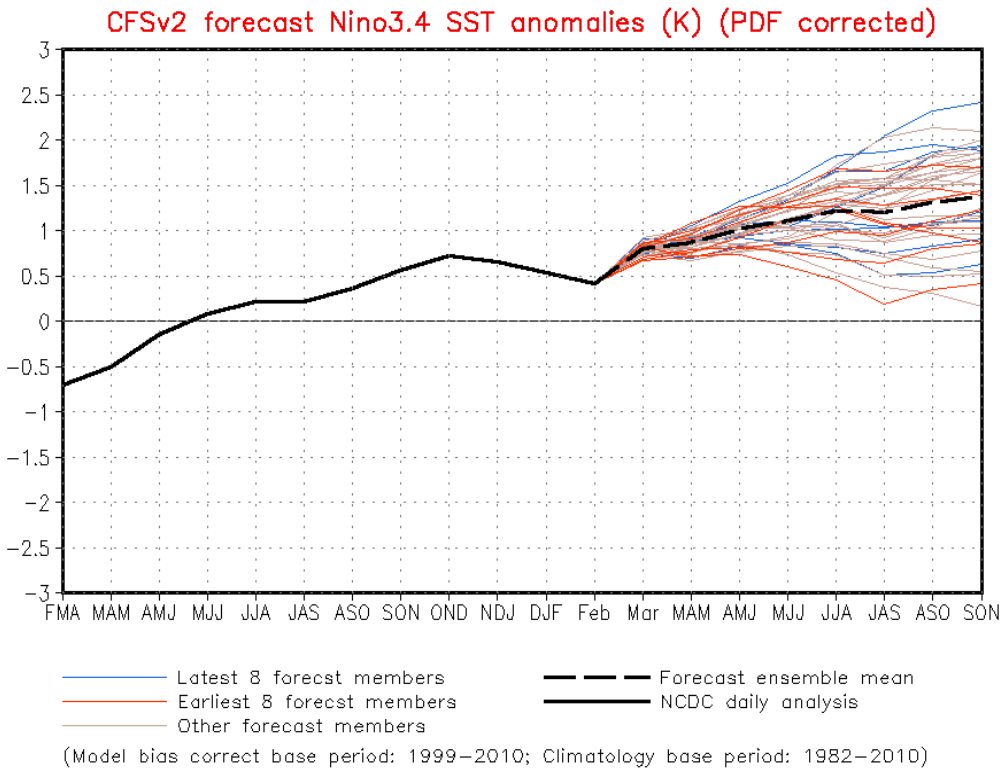


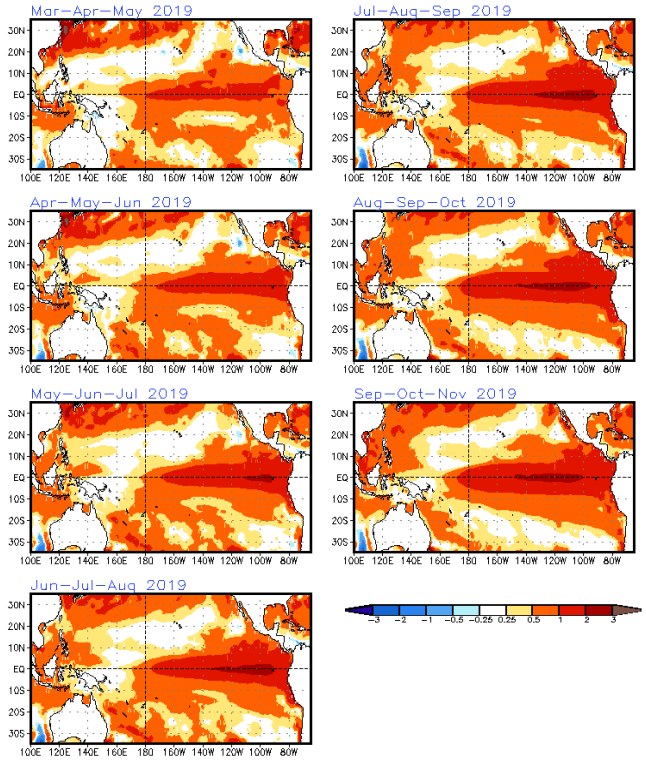
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 19 February 2019).

SST Outlook: NCEP CFS.v2 Forecast (PDF corrected)

Issued: 25 February 2019

The CFS.v2 ensemble mean (black dashed line) predicts El Niño into the Northern Hemisphere fall 2019.



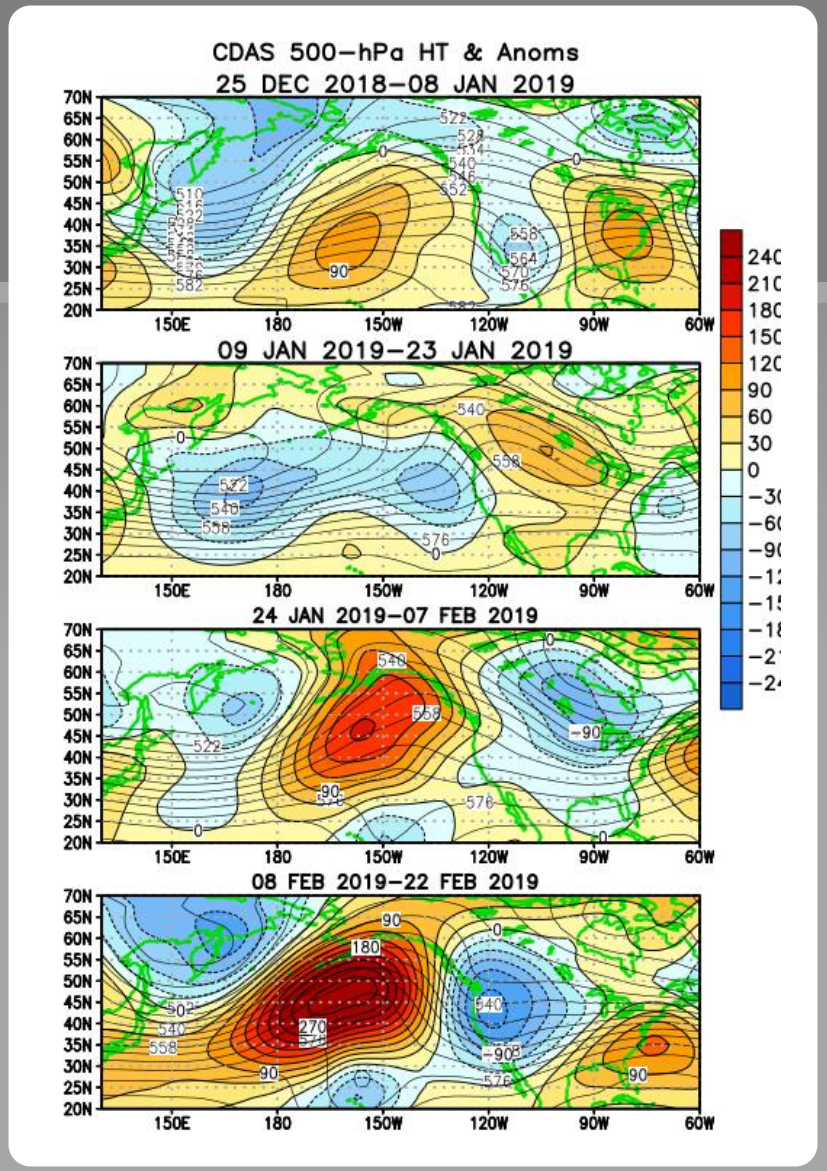


Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

From late December to early January, anomalous ridging (and above-average temperatures) were evident over the central/eastern U.S.

From early January to early February, the pattern changed with anomalous troughing (and below-average temperatures) apparent over the eastern U.S., with anomalous ridging (and above-average temperatures) evident over the central or western U.S.

Since early February, this pattern has flipped, with troughing (and below-average temperatures) over the western U.S. and ridging (and above-average temperatures) over the eastern U.S.



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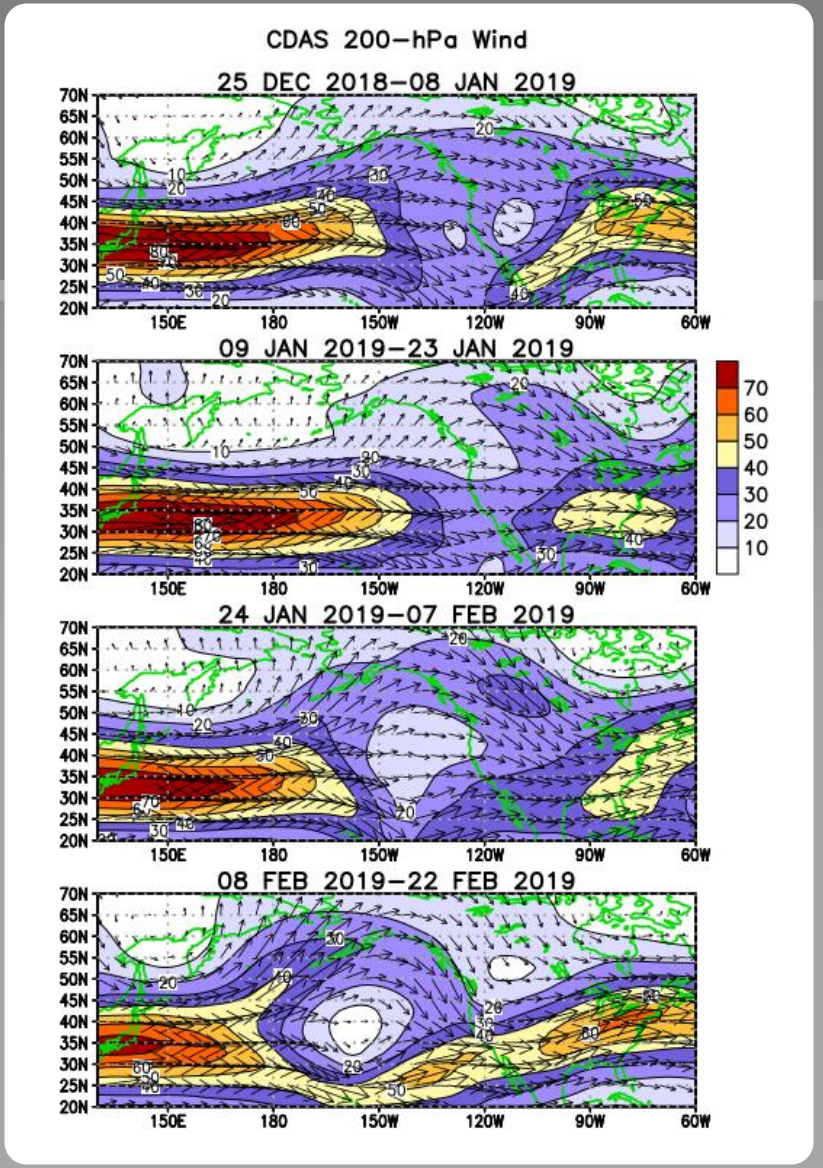

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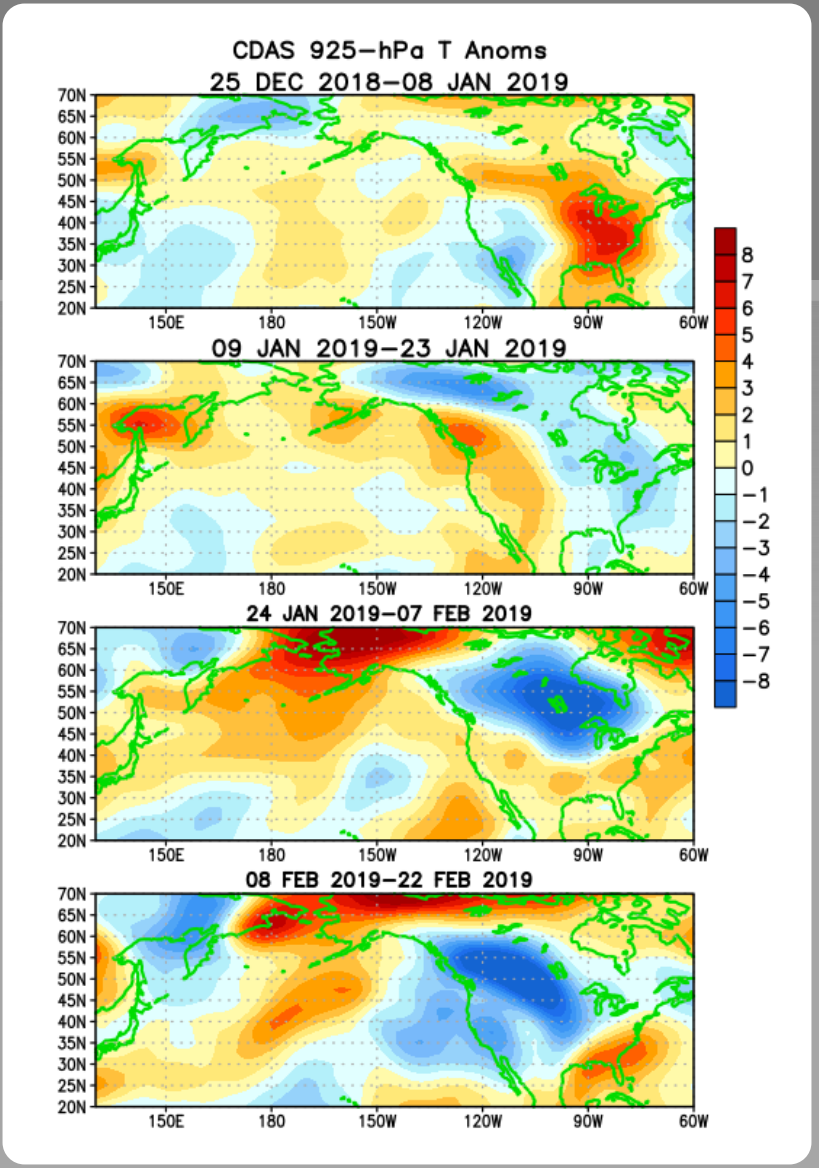
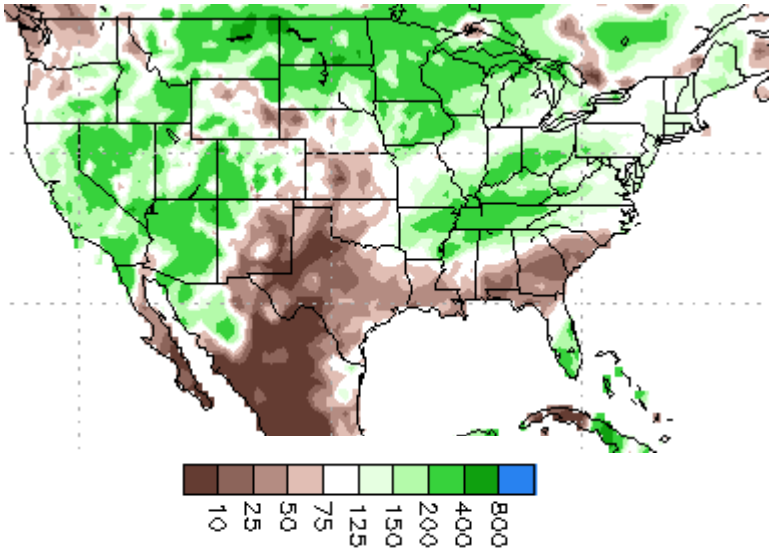


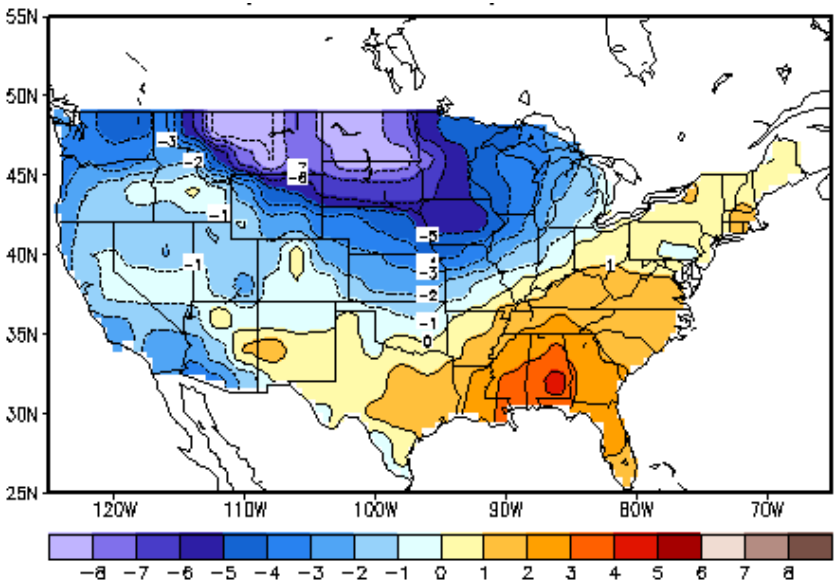
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 23 February 2019

Percent of Average Precipitation



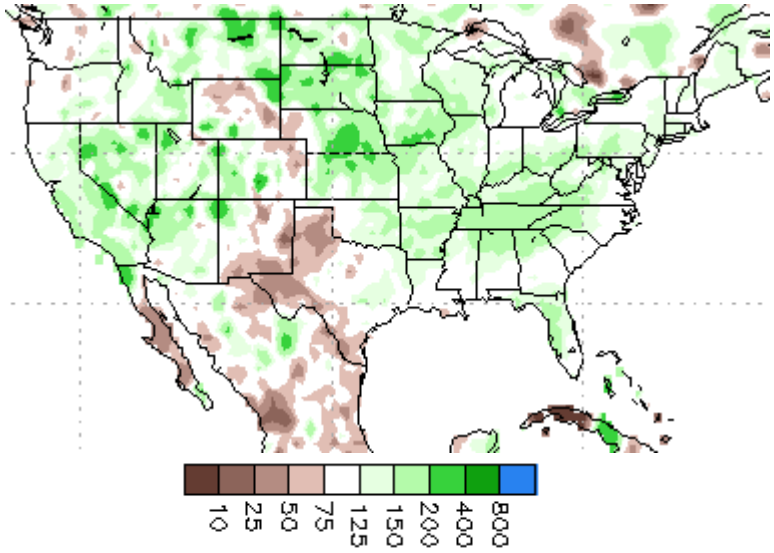
Temperature Departures (degree C)



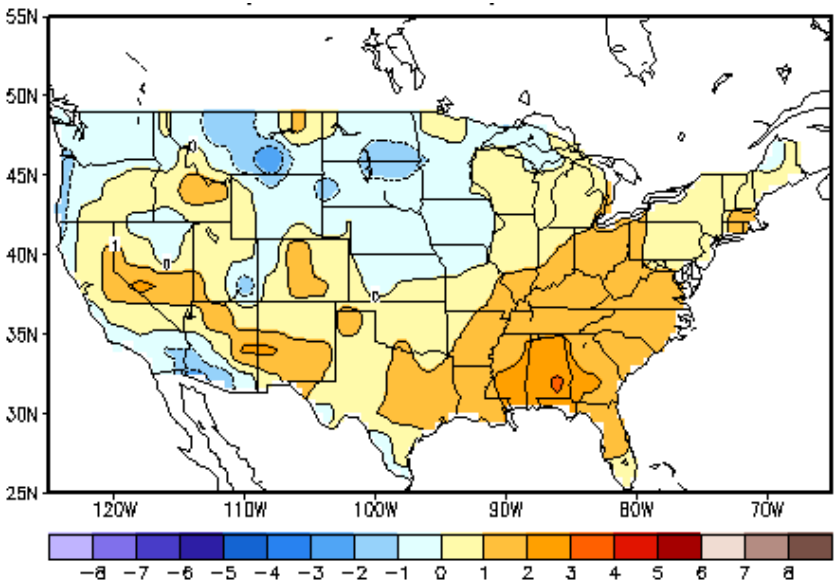
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 23 February 2019

Percent of Average Precipitation



Temperature Departures (degree C)

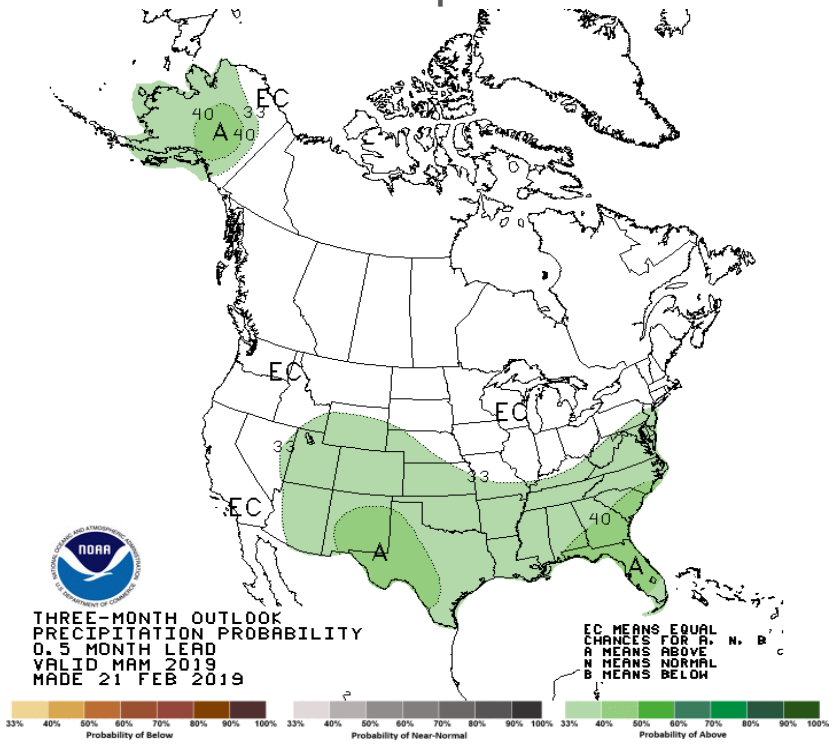


U. S. Seasonal Outlooks

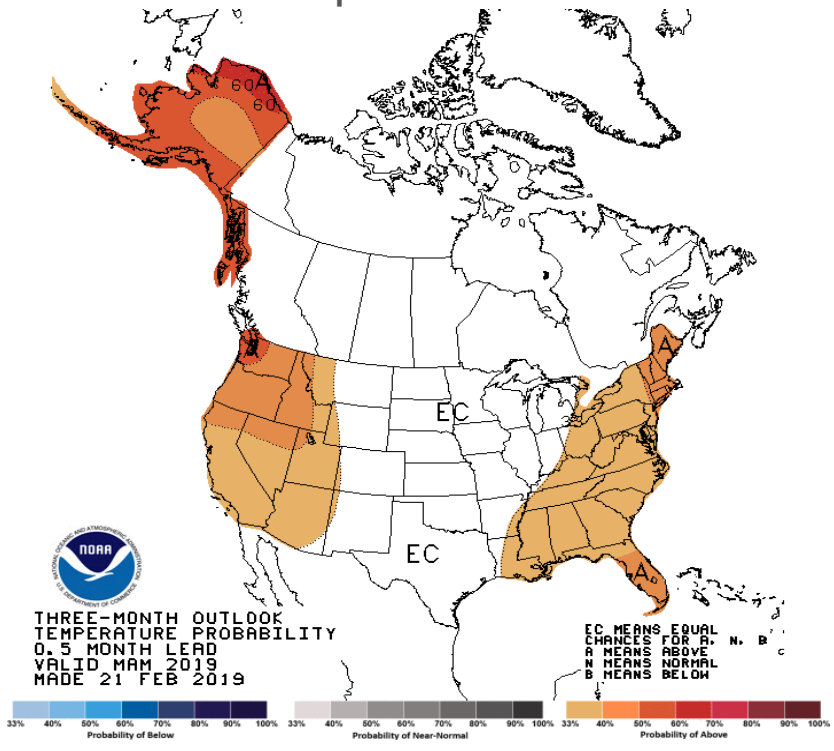
March- May 2019

The seasonal outlooks combine the effects of long-term trends, soil moisture, and, when appropriate, ENSO.

Precipitation



Temperature



Summary

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Weak El Niño conditions are expected to continue through the Northern Hemisphere spring 2019 (~55% chance).*

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